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AN ANALYSIS OF TWO LOGGING ROAD STANDARDS FOR BLM'S TILLAMOOK PROJECT[1]

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INTRODUCTION

Currently, most logging road construction on public lands in the Pacific Northwest is financed from the proceeds of timber sales. In 1965, for instance, only 9.8 percent of the National Forest and 14.0 percent of the Bureau of Land Management mileage of new road construction in Washington and Oregon were built with appropriated funds.

Generally, appropriated funds are used to finance road construction where circumstances dictate a higher standard of road than can be underwritten by a timber sale appraisal, cost allowance deduction; e.g., where multiple use traffic is heavy. But does financing roads with appropriated funds necessarily justify a higher standard of construction than that which the timber operator would build, other things being equal? A recent analysis of roading alternatives for the Tillamook Young-Growth Management Project sheds some light on this question.

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[1] This project was established in Tillamook County, Oreg., by the U.S. Department of Interior's Bureau of Land Management (BLM) to use and test the latest technical and economic young-growth timber management concepts. The Pacific Northwest Forest and Range Experiment Station is assisting in the evaluation phases of the project.

Choice of building lower cost road would expose three times as much timber but result in higher maintenance costs

Funds (approximately $475,000) became available for advance roading a portion of the Bureau of Land Management's 56,000-acre Tillamook project area during fiscal year 1967. The area to be roaded supports a full range of age classes. Therefore, the roads[2] would provide access for thinning in immature stands as well as for harvest cuts. Just how much acreage could be exposed would depend upon the choice of road standard--the higher the standard, the higher the cost per mile and, therefore, the fewer miles of road that could be constructed with appropriated funds. The question to resolve, therefore, was, "Given a fixed budget, which would be the more feasible from an economic standpoint, (1) 8 miles of high-standard 'timber access' roads [see table 1 for a comparison of road specifications] or (2) 24 miles of 'low design-speed'[3] roads?"

Cost per mile for timber access roads was estimated to be three times that for low design-speed roads--$59,374 vs. $19,792. Since $475,000 spent for constructing the latter type of road would result in exposing three times as much timberland for more intensive management (2,886 acres vs. 962 acres), the choice of road standard would appear rather straightforward. But two additional factors affect the decision: (1) hauling cost and (2) road maintenance.

Generally speaking, hauling costs increase as road investment decreases. For any given timber sale tributary to the proposed road segments, total hauling distances will range from 20 to 40 miles. But only 1 mile of this distance, on the average, will be over the proposed roads. For this reason, any difference in hauling costs due to varying the investment of the 1-mile-long road segments would undoubtedly be minor. So, for the purposes of this analysis, hauling costs were assumed to be the same for both road standards.

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[2] The roading situation involves a group of road segments averaging 1 mile in length. Each segment would represent the last leg of the permanent road system required to gain access into a given timbershed.

[3] The average designed speed for this type of road would range from 15 to 20 miles per hour. The average speed for the timber access roads would range from 20 to 25 miles per hour.

Table 1.--Comparison of specifications for low design-speed and access roads[1]

Road specification	Low design-speed road	Access road
Usable width (feet)	12	12
Maximum subgrade width (feet)	16	20
Maximum radius curve (feet)	75	100
Maximum favorable grade (percent)	15	12
Average number of curves per mile	20	11
Average number of turnouts per mile	9	13
Average number of cleared acres per mile	6-1/2	10

[1] The location of the road would be the same for both road standards.

Given the same amount of use, lower standard roads can be expected to cost more to maintain than higher standard roads.[4] For the purposes of this analysis, low design-speed roads were assumed to cost $637 per mile per year to maintain. This cost was estimated by averaging fiscal years 1963 and 1964 Bureau of Public Roads maintenance charges for purchaser-built roads in the Bureau of Land Management's Salem district. Comparable data for timber access roads were not available--this type of road generally receives more use than low design-speed road--but an average annual maintenance cost of $500 per mile was believed fairly realistic.

Economic analysis uses internal rate-of-return criterion

The economic analysis involved a comparison of costs of and returns to the two types of road systems during a 40-year investment period commencing in 1967. A planning horizon of 40 years was selected because logging technology probably will render the roads under question obsolete within this time span.

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[4] Betz, Matthew J. Highway maintenance cost--a consideration for developing areas. In "Highway Research Record No. 94," p. 10. Highway Res. Board, Nat. Acad. Sci., Nat. Res. Counc. Pub. 1310. 1965.

The essential task of the economic analysis was to determine the rate (p) which equated the present value of costs to the present value of revenues for each of the roading alternatives. This was accomplished by discounting to the present all costs and returns associated with a roading investment, using various interest rates, until the difference between the present value of costs and returns was zero. The general equation for solving such a problem is

$$0 = \left[\sum_{j=1}^{t} R_j/(1+p)^n - \sum_{j=1}^{y} C_j/(1+p)^n \right]$$

where

R_j = jth revenue stemming from roading investment, dollars
C_j = jth cost associated with roading investment, dollars
n = year of transaction
p = interest rate, decimal
t = number of revenue items
y = number of cost items

Road construction and maintenance cost assumptions have already been mentioned. However, one additional variable cost item entering into the analysis was the cost of timber sale administration. Currently, the weighted average of such costs for intermediate and harvest cuts is $2.75 per thousand board feet and, for the purposes of this analysis, is assumed to remain at this level indefinitely.

Annual stumpage revenues from tributary timber sales were assumed to remain at $156,418 for the 24 miles of low design-speed roads and $52,162 for the 8 miles of timber access roads. The flow of stumpage receipts is based upon a cutting budget generated by the age-class distribution of forest types exposed by the proposed roads. The method used for determining the volume of timber harvested annually was patterned after the technique (area-volume check) used to regulate the cut from the entire 56,000-acre Tillamook project area. Per-acre yields were modified to reflect thinning operations. A constant stumpage price of $30 per thousand board feet (International 1/8-inch log rule) was used to convert timber volumes to values.

Results of analysis disclose low design-speed road more economical when limited traffic is anticipated

High-standard, timber access roads are undoubtedly more economical than the low design-speed road for situations where moderate-to-heavy traffic is anticipated. But constructing the proposed system of timber sale roads to the timber access road standard represents overbuilding from an economical standpoint in this instance. This statement was substantiated by the comparison of the internal rates of return to the two road-investment alternatives. An investment in 8 miles of high-standard access roads costing $475,200 would earn approximately 9 percent, but an investment of approximately the same magnitude--$475,000--for constructing 24 miles of low design-speed road would earn 27 percent.

SUMMARY

This analysis demonstrates why factors other than maintenance costs must be considered in deciding what road standard to adopt. The lower standard, less expensive, low design-speed roads do cost more to maintain than access roads.[5/] But, in situations where limited use is expected, the difference in annual maintenance charges does not justify the construction of high-standard access roads. In the case of the Tillamook project, $475,200 invested in low design-speed roads will expose three times as much forest land for intermediate and harvest cutting as the same amount invested in access roads, thus generating a flow of revenues which more than compensates for a higher maintenance budget.

[5/] A 3-percent discount rate assumed, annual road maintenance for the low design-speed roads would have to average $3,434 per mile before timber access roads would be more profitable.

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